

TWR - 17272, Vol. VI

FLIGHT SET 360L001 (STS-26) IGNITER,
POST FLIGHT, FINAL REPORT

5 APRIL 1990

Prepared for:

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER, ALABAMA 35812**

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***Thiokol* CORPORATION**
SPACE OPERATIONS

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(NASA-CR-163957) FLIGHT SET 360L001
(STS-26) IGNITER, POST FLIGHT Final Report
(Thiokol Corp.) 39 p CSCL 151

KPO-26525

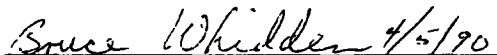
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FLIGHT SET 360L001 (STS-26)
IGNITER FINAL REPORT VOLUME VI

PREPARED BY:


E. J. HALE
IGNITION, INSTRUMENTATION AND ELECTRICAL DESIGN

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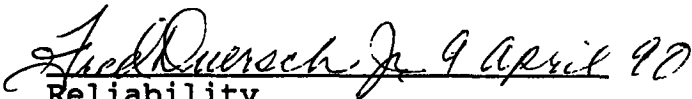

BRUCE WHIDDEN, SUPERVISOR
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Non Metallic Component Design


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Project Management


System Safety


Reliability


Data Management

1.0 INTRODUCTION

Space Transportation System (STS-26) was launched from KSC pad 39B on September 29 1988. Two of the Redesigned Solid Rocket Motors (RSRM) were part of the launch system and are designated RSRM-1A and RSRM-1B. Each of these motors were initiated by an 1U75164 igniter.

Following rocket motor separation and splashdown, the motors were recovered and towed to hanger AF for inspection and disassembly. This inspection was performed per Post Flight Engineering and Evaluation Plan (PEEP) TWR-16475, vol. VI, which outlines the basic evaluations to be performed at KSC Hanger AF.

2.0 OBJECTIVES

The objective of this report is to document the post flight condition of the Igniters and associated components.

The following objectives of TWR-17535 are addressed in this report. (Numbers in parenthesis identify CEI specification paragraphs)

Qualification Test Objectives by Inspection

- H. Post flight inspection of all RSRM seals for evidence of blow-by or erosion (3.2.1.2).
- T. Post flight inspection of seals for satisfactory operation within temperature range resulting from natural and induced environments (3.2.1.2.3.b, 3.2.1.3.4.b, 3.2.1.2.5.b).
- AF. Post flight inspection of ignition system seals for evidence of hot gas leakage (3.2.1.4.6.a).
- AG. Post flight inspection of igniter for evidence of debris formation or damage (3.2.1.4.13).
- AH. Post flight inspection of insulation for required performance (3.2.1.8.1.1.f).
- AI. Post flight inspection of insulation for required performance (3.2.1.8.1.1.e).
- AM. Post flight inspection for thermal damage to igniter chamber or adapter metal parts (3.2.1.8.2).
- AN. Post flight inspection of case, igniter, S&A, OPT and igniter chamber pressure transducers for reusability (3.2.1.9.a, 3.2.1.9.d, 3.2.1.9.e, 3.2.1.8.3).

AS. Post flight inspection of identification numbers of reusable components for traceability (3.2.1.5)

3.0 APPLICABLE DOCUMENTS

1U75164 Igniter Rocket Motor, Modified

1U75165 Modified Ignition System, Fwd Seg Assy

TWR-16475 Vol VI Igniter Component, KSC Postfire Engineering Evaluation Plan

TWR-17198 Vol VI Post Fire Engineering Evaluation Comments (Igniter components)

4.0 SUMMARY/CONCLUSIONS

The overall performance of the igniter components was excellent. No damage or heat affected areas were noted.

The sealing elements of the igniter functioned as expected with no evidence of erosion or blowby.

The thermal protection system protected all areas adequately. No excessive erosion was noted.

Corrosion was found in the special bolt holes in the igniter chamber. The corrosion will not affect refurbishment of the chamber. Beginning with flight 5 grease has been added to the chamber holes to prevent this erosion.

5.0 RESULTS/DISCUSSION

5.1 SEALING SYSTEM

5.1.1 Left Safe and Arm Device to Adapter

The grease application was not readily detectable on all surfaces. There was no grease on the seals. There was no evidence of hot gas past the primary seal on the safe and arm gasket. There was soot located intermittently on the aft side of the gasket and matching locations on the safe and arm from 125 to 195 degrees (70 degree arc), and from 200 to 270 degrees (70 degree arc). (Figure 1) The condition of the joint was nominal. There was no corrosion or damage found to the joint or gasket seals at disassembly. (Page B1 of Appendix B and Figure 2)

5.1.2 Left Igniter Chamber to Adapter

No blow holes were found in the putty, therefore, no soot reached the inner primary seal. No damage was observed on the gasket seals. Soot was found leading to the outer primary seal on the aft side of the inner gasket from 30 to 0 to 120 degrees (270 degree arc). All Stat-O-Seals from the inner joint bolts were damaged. It has been determined this damage occurred when the bolts were retorqued prior to disassembly of the igniter or during disassembly of the igniter. (Page B2 of Appendix B)

The grease was light and per design, however, there was light circumferential corrosion on the adapter plate, forward of the outer joint primary seal and in the region between the inner seal and outer seal. (Figure 3) There was corrosion on the tips of all transducer bolts and in the bottom of all transducer bolt holes located at 40, 100, 180, and 270 degrees. (Figure 4) This corrosion will not cause a refurbishment problem because it is not on the sealing surfaces.

5.1.3 Left Igniter Joint Adapter-to-Forward Dome

No evidence of hot gas leakage past the primary seal or damage on the joint or gasket seals was found. There was corrosion around the full circumference on the inside diameter of the forward dome boss and over the edge to the inside. Most of the corrosion was very light with a few heavier areas. None of the corrosion seen will affect the components ability to be refurbished. (Figure 5)

A putty blowhole was observed at 285 degrees, which was 1.625 inches wide at the entrance with 0.75 inch mid-width and 1.5 inch outlet width. (Figure 6)

On the aft face of the gasket there was soot to the primary seal from 220 to 310 degrees (90 degree arc). The majority of this soot was light. Heavier soot was found on the primary seal from 250 to 290 degrees (40 degree arc). Soot was over the edge of the forward face of the gasket approximately 0.10 inch from 270 to 300 degrees (60 degree arc). (Page B3 of Appendix B)

5.1.4 Right Safe and Arm to Adapter

No evidence of hot gas past the primary seal on the Safe and Arm gasket was found. Soot was found on the primary seal on the aft side of the gasket from 108 to 144 degrees (36 degree arc). Soot was barely detectable on the gasket and was more evident on the igniter adapter surface. (Figure 7)

The condition of the joint was nominal, as there was no grease on

the seals or corrosion on the retainer. No damage to the joint or gasket seals was observed. (Page B4 of appendix B)

5.1.5 Right Igniter Chamber-to-Adapter

No blow holes were found in the putty, therefore, no soot reached the inner primary seal. Light soot was found leading to the outer primary seal on the aft side of the inner gasket around the full circumference, and heavier soot was found from 30 to zero to 230 degrees (160 degree arc). (Figure 8)

All Stat- O-Seals from the inner joint bolts were damaged. It has been determined this occurred when the bolts were retorqued prior to disassembly of the igniter or during the disassembly of the igniter. No gasket seal damage was observed.

5.1.6 Right Igniter Joint Adapter-to-Forward Dome

No evidence of hot gas leakage past the primary seal and was found and no seal damage was observed on the gasket. A putty blow hole was observed at 320 degrees. (Figure 9) It was 1.0 inch wide at the entrance and necked down to 0.625 inch at the exit. This blowhole is typical of what has been seen before. (Page B5 and B6 of appendix B)

On the aft face of the gasket, there was light soot to the primary seal from 162 to 252 degrees (90 degree arc), and heavier soot to the primary seal from 252 to 266 degrees (14 degree arc). The forward face showed intermittent soot to the primary seal from 240 to 340 degrees (100 degree arc), and light soot intermittent over the edge to the primary seal over the full circumference. (Figure 10)

Corrosion was found on the inside edge of the forward dome boss and outside edge. This corrosion has been seen in the past. The corrosion occurs when the gases from the motor fill the volume past the putty and when sea water enters this cavity. The corrosion seen at this time will not affect the components ability for refurbishment. (Figure 11 and 12)

No gasket seal damage was observed.

5.1.7 Special Bolts to Chamber

All eight special bolts showed no signs of heating or blowby past the seals. No signs of physical damage to the seals, bolt or igniter chamber area. Corrosion was observed on the bottom of all 8 special bolts (figure 13). This corrosion came from the igniter chamber. The bolts are made of corrosion resistant steel. This corrosion in the chamber is below the sealing surface area. None

of the corrosion seen will affect the bolts or bolt chambers ability for refurbishment. The corrosion is caused by combustion products and by salt water which is forced up the transducer pressure ports during splash down. This has been seen in the past.

All special bolts performed as predicted. RSRM 5 and subsequent flights will have added grease in this area to prevent corrosion.

5.2 Insulation

The thermal protection on both igniters performed as predicted. No abnormal hot spots or erosion was seen. The water from splash down washed the OD chamber insulation clean of char. The chamber ID insulation, the adapter insulation and initiator insulation had uniform layers of char. Char depths were typical.

The areas of the insulation which have the most heat affects were measured for thickness prior to flight and after flight. Figure A1 shows the location of the thickness measurements. Table AI, Insulation Thickness History, shows a summary of insulation char depth for all igniters tested in the RSRM program. Location #8 sees char depth that exceed the 1.5 required safety factor. This area of excessive charring is not a concern for safety. Waver # RVW579 R1 has been submitted and approved by NASA for this area only. Visual inspection of all RSRM igniter shows no excessive heating in this area. (Pages B7 and B8 of Appendix B)

5.3 Nozzle insert

The nozzle insert for each igniter remained firmly bonded in place and showed no excessive char depth. No structural damage or heat damage was seen on either nozzle insert. Both inserts performed as predicted. (Pages B9 and B10 of Appendix B)

6.0 METAL COMPONENTS

No structural damage was noted on any metal components. No bolts showed signs of yielding or damage. No yielding or damage was seen in the metal portion of the packing with retainer (1U75375). (Pages B11 and B12 of Appendix B)

6.1 ULTRASONIC PRELOAD OF BOLTS

The inner bolts (igniter chamber to adapter) were switched at KSC, prior to flight, to incorporate the ultrasonic preload measuring method. The bolts were loaded to 52-57 KPS.

Prior to removal, the bolts were checked for ultrasonic length and to see at what torque the bolts would move clockwise. After removal, the bolts were checked for ultrasonic preload. A comparison of pre torques and preloads vs. postfire torques and preloads is summarized in Table I. All torques and preloads are within excepted values and accuracy of the instruments.

7.0 IGNITION SYSTEM COMPONENT TEAM RECOMMENDATIONS

The Igniter System Components Program team has reviewed all observations presented in this document and determined that only two potential anomalies exist. These potential anomalies are listed below.

7.1 OBSERVATION

1. Blowholes in the outer joint putty on both the left and right igniters.

Decision was to continue to use the present design.

7.2 MINOR ANOMALIES

1. None.

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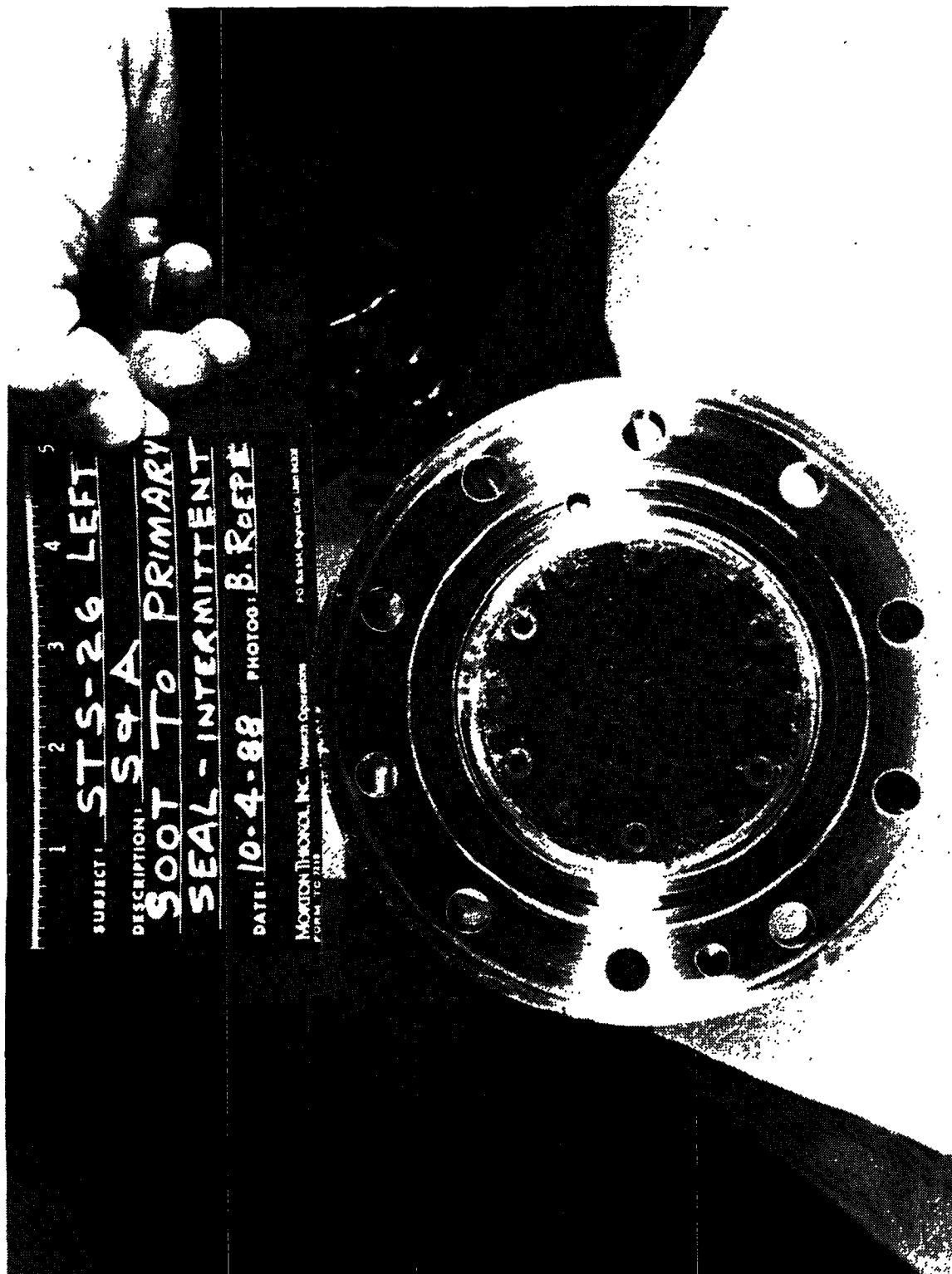


Figure 1. Safe and Arm Soot to Primary Seal Left Motor

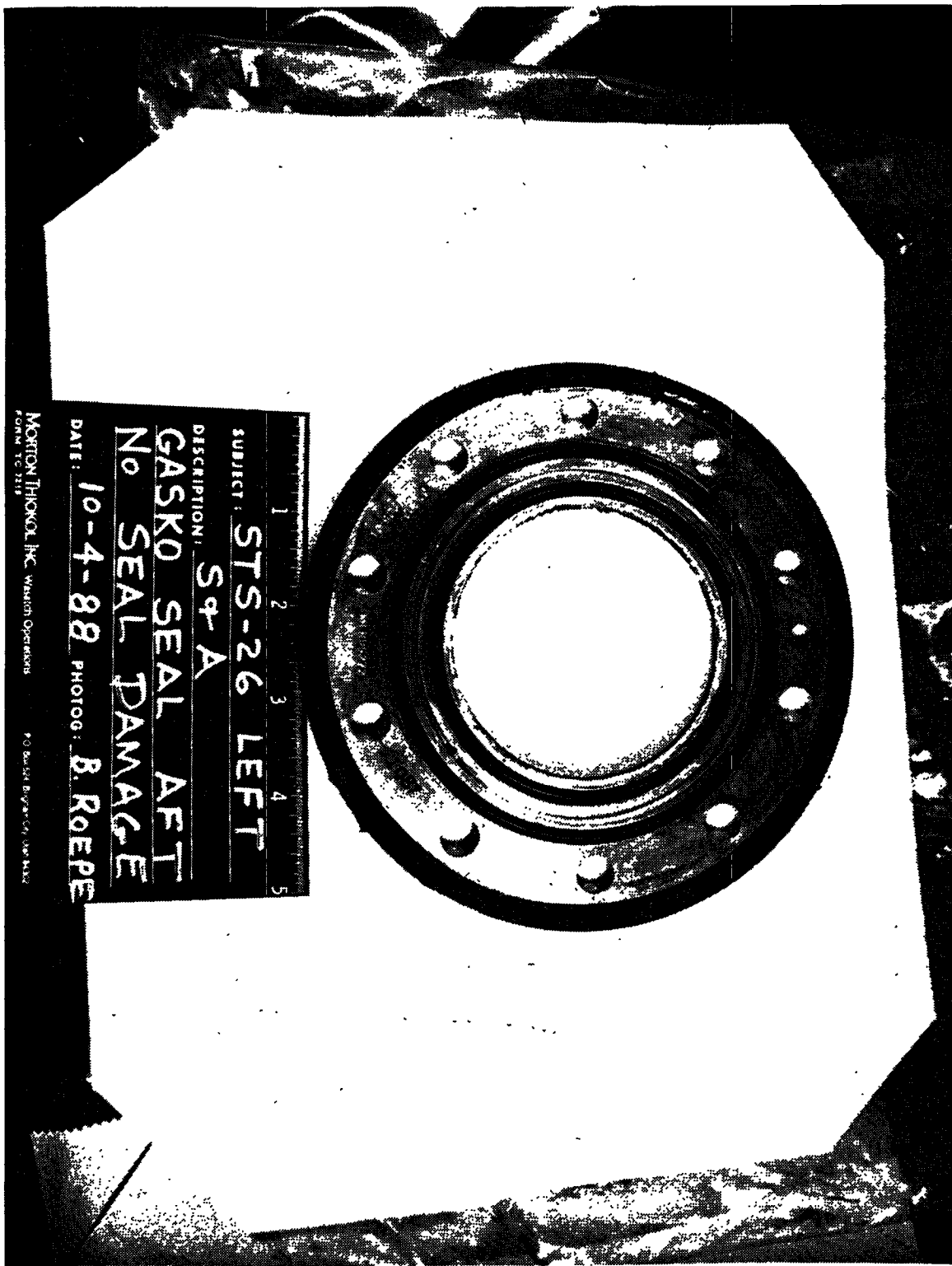


Figure 2. Safe and Arm Gasko Seal Left Motor

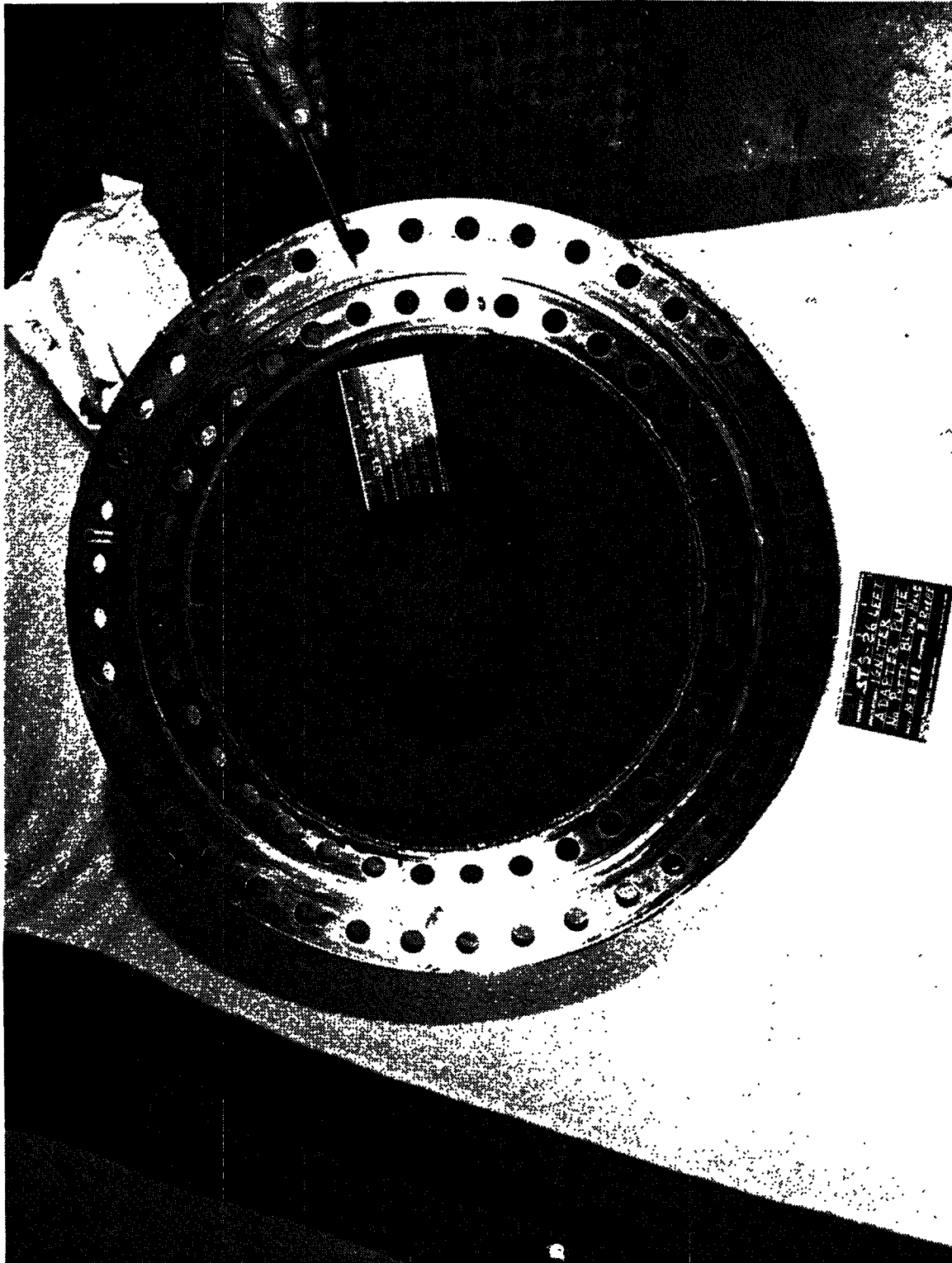


Figure 3. Igniter Adapter Plate Corrosion Left Motor



Figure 4. Igniter Transducer Bolt Corrosion



Figure 5. Igniter Forward Dome Boss Corrosion Left Motor

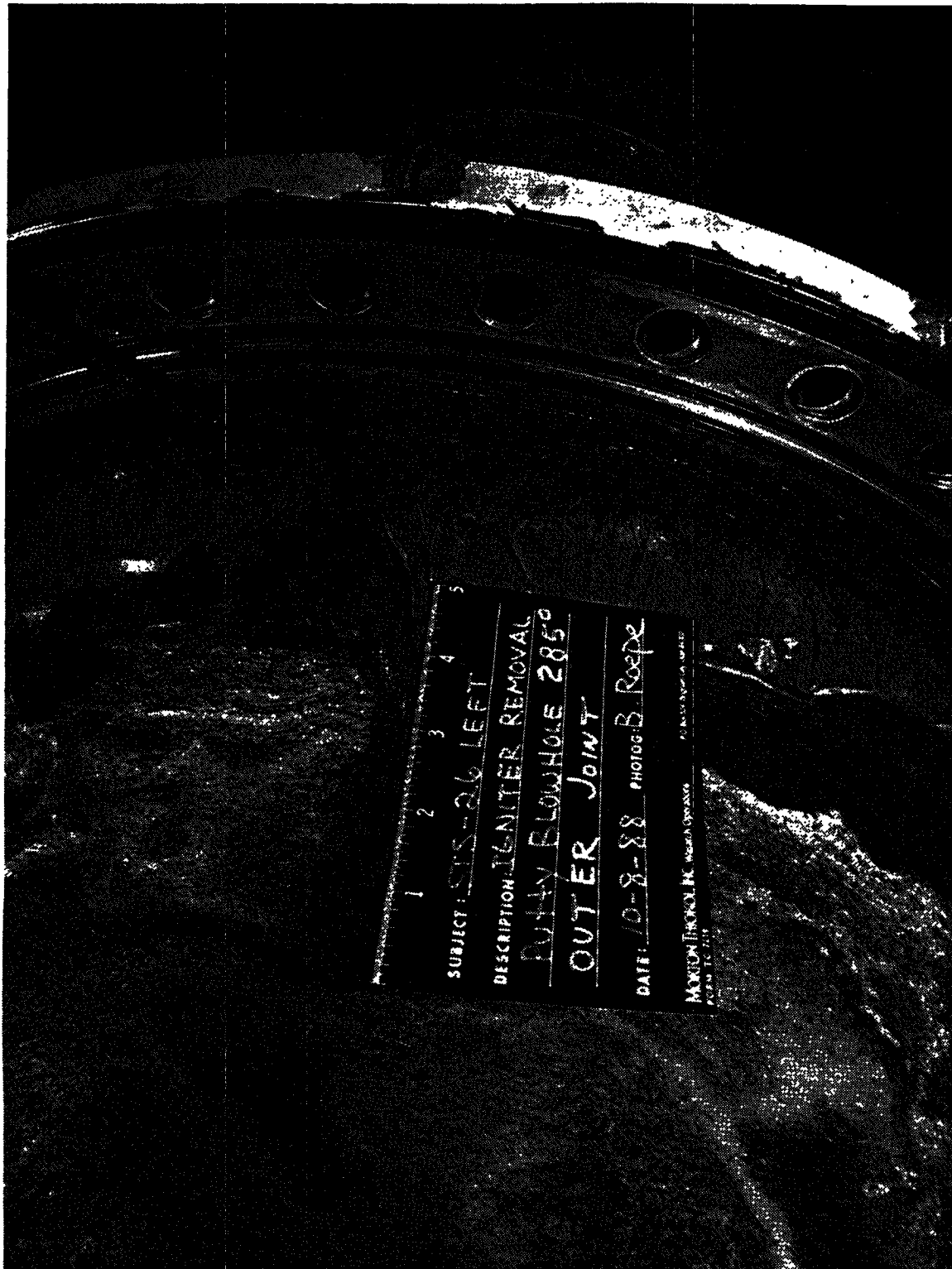


Figure 6. Igniter Putty Blowhole Left Motor



Figure 7. Safe and Arming Adapter Soot Right Motor

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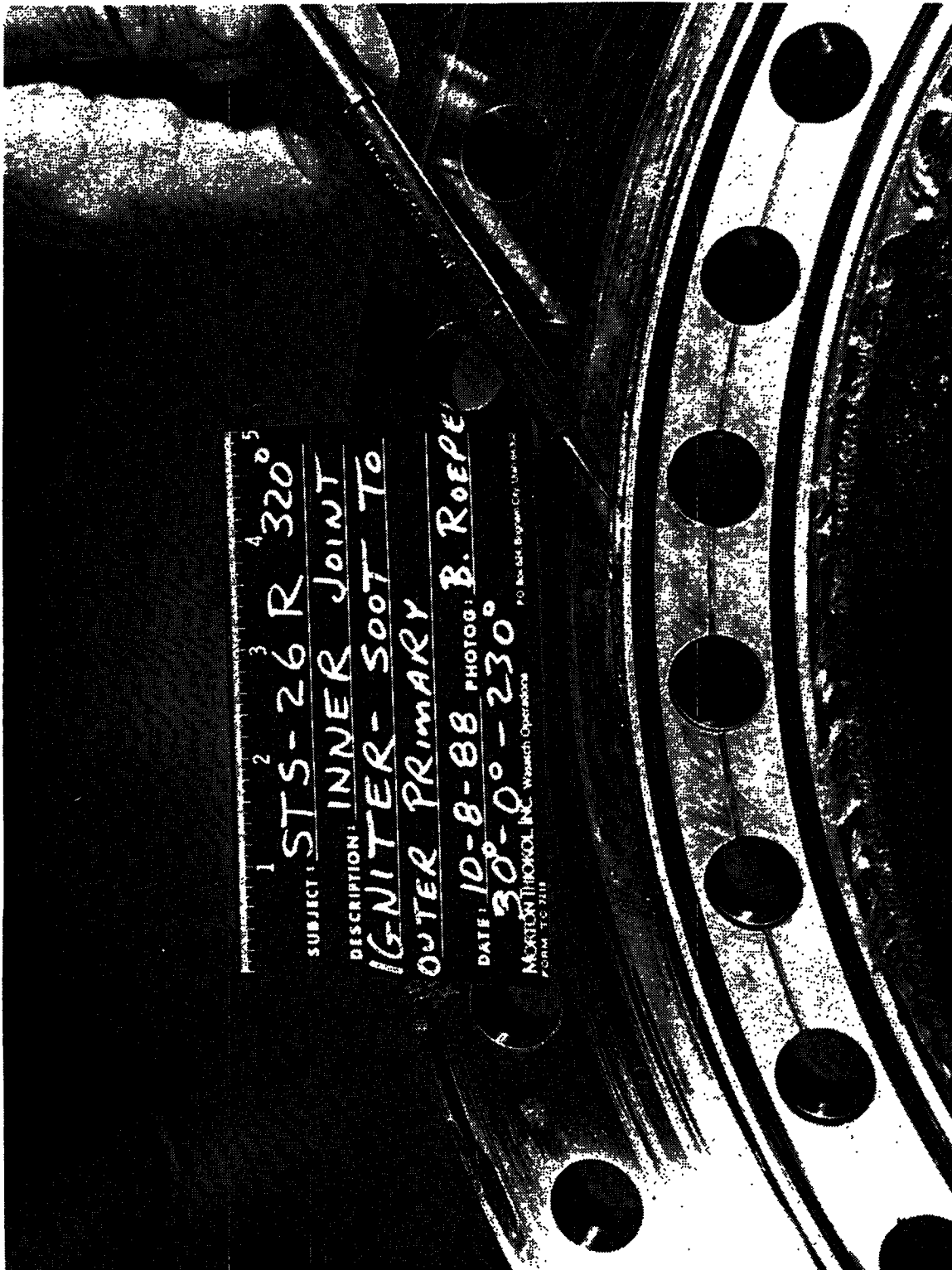


Figure 8. Igniter Inner Joint Soot Right Motor

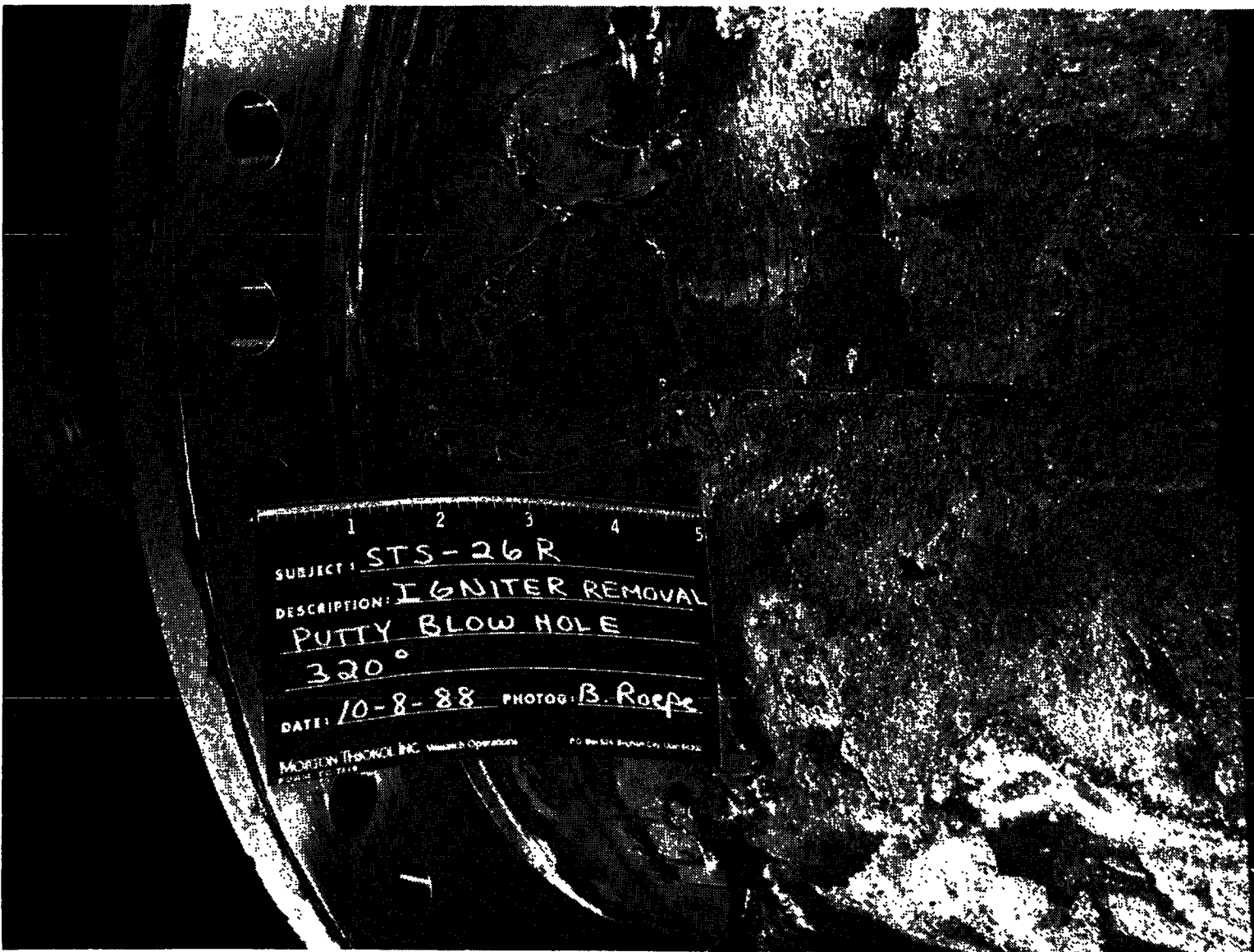


Figure 9. Igniter Putty Blowhole Right Motor



Figure 10. Igniter Gask-O-Seal Soot Right Motor

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Figure 11. Forward Dome Corrosion Right Motor

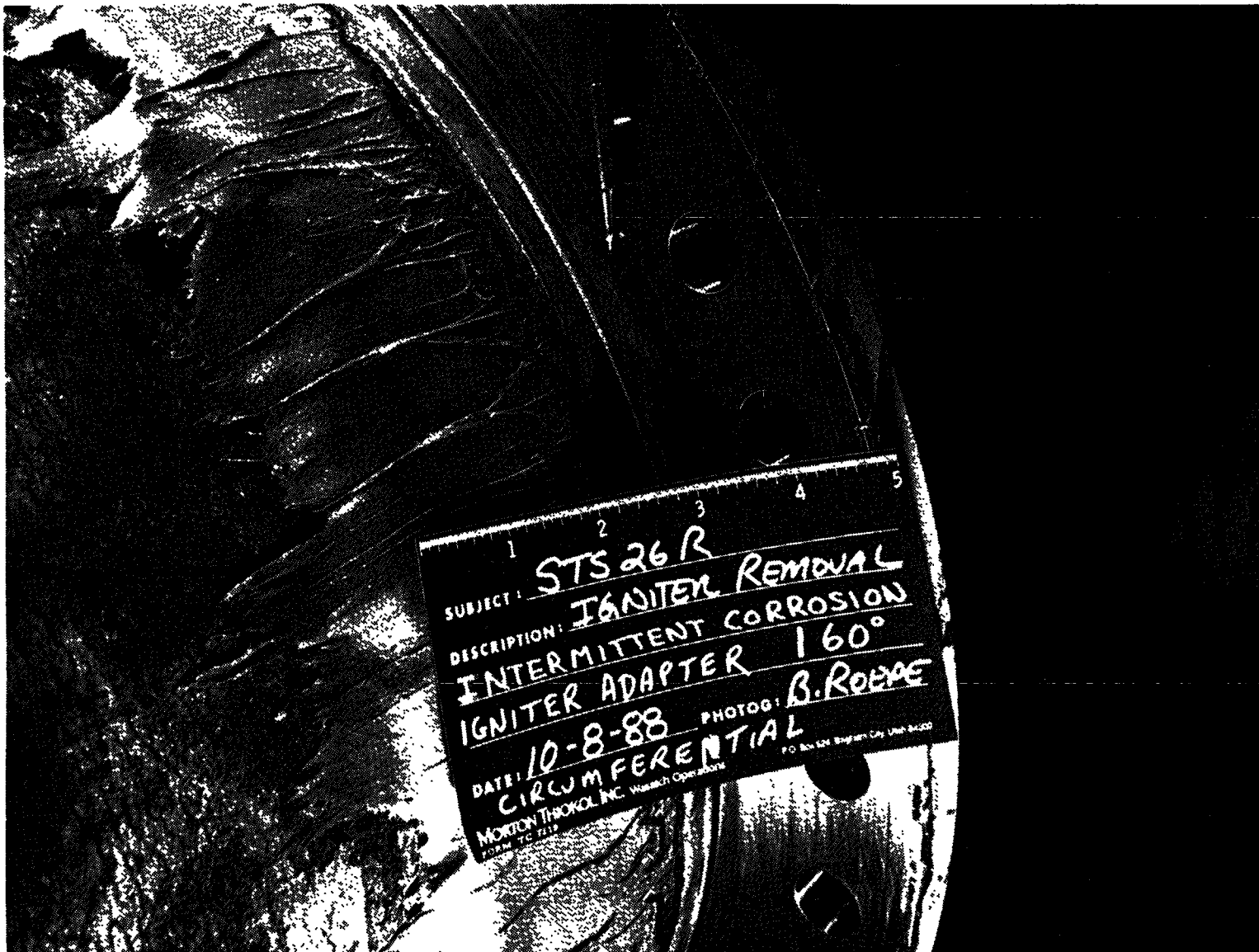


Figure 12. Igniter Adapter Corrosion Right Motor



Figure 13. Special Bolt Corrosion

FLIGHT 1 IGNITER BOLT MEASUREMENTS

RIGHT MOTOR

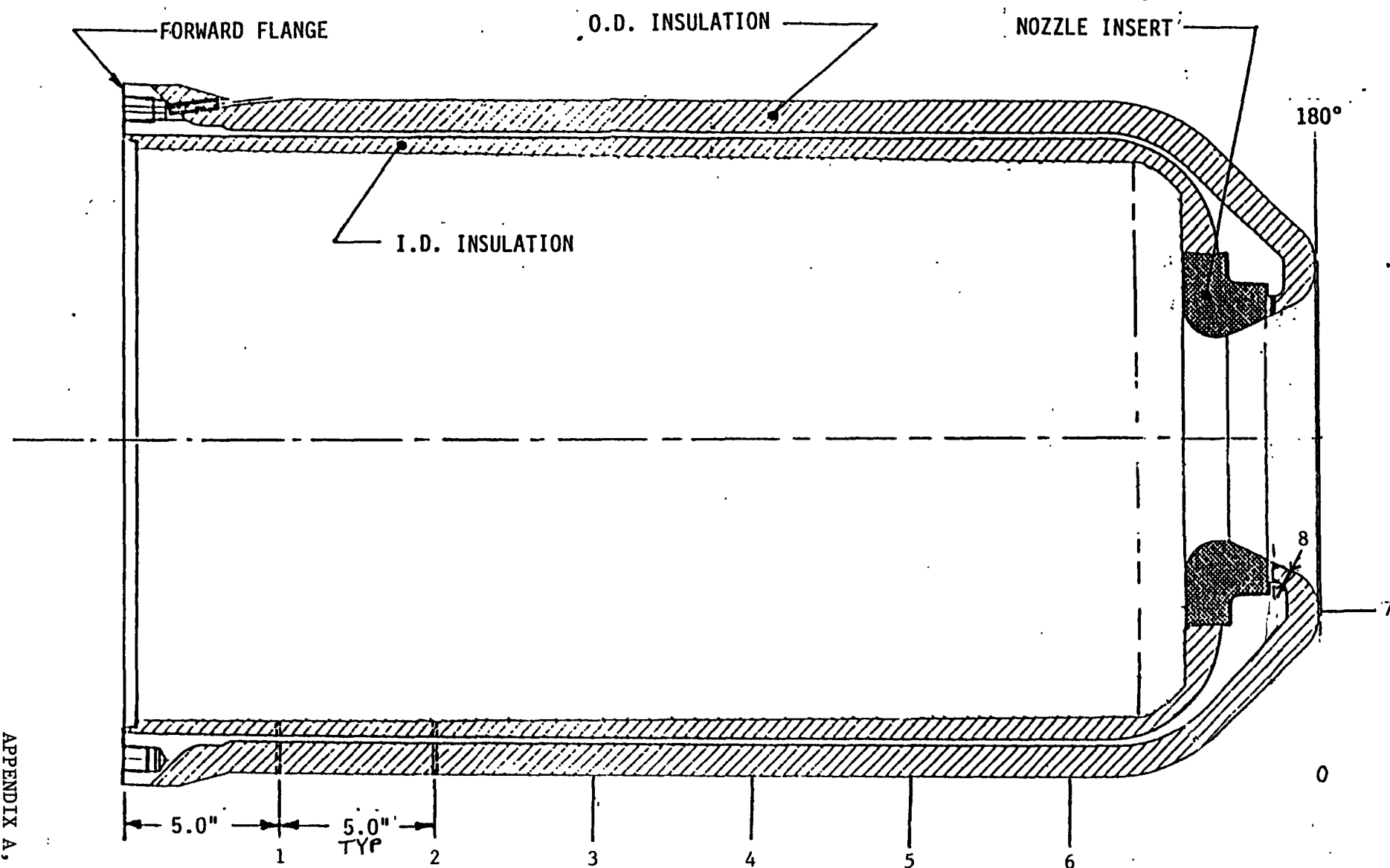
LEFT MOTOR

INNER BOLTS				OUTER BOLTS		INNER BOLTS			
DEGREE LOCAT.	TORQUE	LOAD	RATIO	DEGREE LOCAT.	TORQUE	DEGREE LOCAT.	TORQUE	LOAD	RATIO
0	430	49888	116.	0	275	0	460	54482	118.
10	450	52185	115.	9	250	10	520	52185	100.
20	410	55247	134.	18	225	20	460	56013	121.
30	410	52915	129.	27	225	30	390	59075	151.
50	470	53716	114.	36	280	50	430	50654	117.
60	440	50654	115.	45	270	60	500	52951	105.
70	460	52185	113.	54	320	70	490	49123	100.
80	520	52185	100.	63	280	80	470	59841	127.
90	440	55247	125.	72	330	90	450	56779	126.
110	500	47581	95.1	81	300	110	410	55247	134.
120	515	56779	110.	90	275	120	450	53716	119.
130	460	55247	120.	99	300	130	460	49123	106.
140	530	52185	98.4	108	310	140	480	53716	111.
150	430	52185	121.	117	280	150	460	49888	108.
160	440	53716	122.	126	280	160	440	53716	122.
170	505	56013	110.	135	315	170	470	58310	124.
190	490	72091	147.	144	265	190	410	54482	132.
200	430	53716	124.	153	290	200	410	48357	117.
210	460	56013	121.	162	300	210	440	54482	123.
220	490	51419	104.	171	300	220	460	50654	110.
230	490	55247	112.	180	300	230	450	57544	127.
240	470	55247	117.	189	280	240	440	57544	130.
250	440	50654	115.	198	330	250	470	53716	114.
260	505	53716	106.	207	280	260	390	60707	155.
280	470	53716	114.	216	290	280	420	48357	115.
290	430	55247	128.	225	295	290	410	56013	136.
300	450	56779	126.	234	300	300	410	55247	134.
310	420	51419	122.	243	280	310	490	50654	103.
320	400	52185	130.	252	290	320	390	56013	143.
330	470	51419	109.	261	295	330	430	55247	128.
340	440	54482	123.	270	270	340	450	51419	114.
350	550	53951	98.0	279	330	350	500	58310	116.
				288	280				
				297	270	SPEC. BOLTS			
				306	280	40	290		
				315	280	100	260		
				324	320	180	270		
				333	270	270	260		
				342	290				
				351	270				

Torque = the force required to turn the bolts clockwise
 Load = the preload on the bolts as measured ultrasonically.
 Ratio = load/torque

APPENDIX A

TWR-17272, VOL. VI



Post Test Plug Positioning For Insulation Measurements

FIGURE A1

IGNITER INSULATION HISTORY

MOTOR	LOCATION	PRE FIRE THICKNESS								POST FIRE THICKNESS								FACTOR OF SAFETY							
		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
DM-9	0 DEGREES	1.04	1.01	1	1	1.1	1.03	1.1	0.4	0.807	0.843	0.76	0.764	0.736	0.781	0.775	0.128	4.46	6.04	4.16	4.23	3.02	4.13	3.38	1.47
	180 DEGREES	0.99	1.01	1	0.98	1.02	1.04	1.07	0.4	0.872	0.816	0.787	0.796	0.762	0.731	0.761	0.142	8.38	5.20	4.69	5.32	3.95	3.36	3.46	1.55
QM-6	0 DEGREES	1.039	1.03	1.021	1.021	0.992	1.097	1.064	0.415	0.838	0.848	0.93	0.8	0.777	0.768	0.969	0.183	5.16	5.65	11.2	4.61	4.61	3.33	11.2	1.78
	180 DEGREES	0.99	0.987	1.009	1.011	1.006	1.026	1.003	0.405	0.799	0.82	0.838	0.738	0.759	0.722	0.96	0.182	5.18	5.91	5.90	3.70	4.07	3.37	23.3	1.81
QM-7	0 DEGREES	1.091	1.068	1.052	1.054	1.046	1.106	1.049	N/A	0.818	0.808	0.817	0.823	0.837	0.763	0.892	0.624	3.99	4.10	4.47	4.56	5.00	3.22	6.68	N/A
	180 DEGREES	1.045	1.058	1.047	1.054	1.144	1.011	1.059	N/A	0.805	0.798	0.793	0.826	0.75	0.782	0.91	0.733	4.35	4.06	4.12	4.62	2.90	4.41	7.10	N/A
QM-8	0 DEGREES	1.073	1.028	1.009	1.025	1.031	1.01	1.055	0.404	0.832	0.781	0.763	0.69	0.708	0.752	0.678	0.468	4.45	4.16	4.10	3.05	3.19	3.91	2.79	N/A
	180 DEGREES	1.078	1.023	1.025	1.026	1.025	1.01	1.068	0.471	0.89	0.746	0.781	0.746	0.737	0.773	0.703	0.47	5.73	3.69	4.20	3.66	3.55	4.26	2.92	N/A
PV-1	0 DEGREES	1.055	1.085	1.069	1.054	1.07	1.064	1.037	0.447	0.912	0.881	0.85	0.81	0.75	0.808	0.784	0.205	7.37	5.31	4.88	4.31	3.34	4.15	4.09	1.84
	180 DEGREES	1.06	1.075	1.036	1.036	1.075	1.064	0.998	0.432	0.918	0.868	0.77	0.778	0.76	0.86	0.678	0.19	7.46	5.19	3.89	4.01	3.41	5.21	3.11	1.78
FLIGHT 1A	0 DEGREES	0.999	1.06	1.046	1.024	1.048	1.107	1.046	N/A	0.915	0.813	0.88	0.79	0.81	0.808	0.785	0.436	11.8	4.29	6.30	4.37	4.40	3.70	4.00	N/A
	180 DEGREES	0.936	1.04	1.024	1.024	1.012	1.071	1.041	N/A	0.85	0.818	0.778	0.795	0.765	0.68	0.65	0.415	10.8	4.68	4.16	4.47	4.09	2.73	2.66	N/A
FLIGHT 1B	0 DEGREES	0.982	1.025	1.028	1.029	1.027	1.126	1.035	0.423	0.835	0.822	0.815	0.817	0.778	0.882	0.6	0.295	6.68	5.04	4.82	4.85	4.12	4.61	2.37	3.30
	180 DEGREES	0.993	1.033	1.024	1.024	1.024	1.092	1.041	0.423	0.79	0.772	0.756	0.768	0.778	0.782	0.612	0.275	4.89	3.95	3.82	4	4.16	3.52	2.42	2.85

N/A = NOT AVAILABLE

INCOR = MEASUREMENT TAKEN AT WRONG LOCATION OR
CHAR WAS NOT REMOVED

Igniter Insulation History

TABLE A1

APPENDIX B

Morton Thiokol Inc.
Space Operations

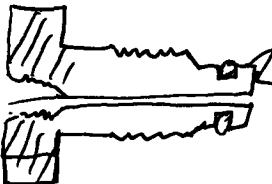
Table A-II
Safe & Arm - Evaluation Checkoff Worksheet

Inspector(s): <i>Pat McCloskey</i>				
Motor No.: <i>26 R</i>		Side: <input checked="" type="checkbox"/> Left(A) <input type="checkbox"/> Right(B)		Date: <i>10/9/88</i>
I.	Heat Affect (Blisters or Discoloration)?	_____ yes	<u><i>X</i></u> no	
II	Physical Damage (Nicks, Scratches, Gouges)?	_____ yes	<u><i>X</i></u> no	
III.	Corrosion?	_____ yes	<u><i>X</i></u> no	
If yes, note:				
	Condition (I, II, or III)	Degree Location (Deg.)	Circumferential Width (In.)	Degree Arc
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
Notes / Comments <i>No unacceptable conditions</i>				

Morton Thiokol Inc.
Space Operations

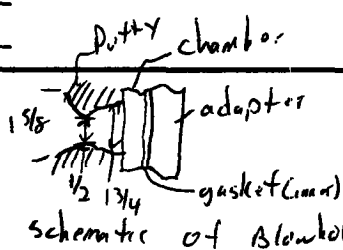
Table A-IV
Igniter Instrumentation (Removed) - Evaluation Checkoff Worksheet

Inspector(s): <u>Pat McCluskey</u>			
Motor No.: <u>26 R</u>	Side: <input checked="" type="checkbox"/> Left(A) <input type="checkbox"/> Right(B)	Date: <u>10/9/88</u>	
I. Evidence of Combustion Product Leakage (i.e. Soot)?			
A. Transducers	_____ yes	<u>X</u> no	
B. Transducer Bolt Assemblies	_____ yes	<u>X</u> no	
C. Plugs	_____ yes	<u>X</u> no	
If Yes:			
Affected Part (A, B or C)	Degree Location (Deg)		
_____	_____		
_____	_____		
_____	_____		
_____	_____		
II. Physical Damage (Nicks, Scratches, Gouges)?			
A. Transducers	_____ yes	<u>X</u> no	
B. Transducer Bolt Assemblies	_____ yes	<u>X</u> no	
C. Plugs	_____ yes	<u>X</u> no	
If Yes:			
Affected Part (A, B or C)	Degree Location (Deg)		
_____	_____		
_____	_____		
_____	_____		
_____	_____		
III. Plugged Ports? _____ yes <u>X</u> no			
If Yes: Degree			
Location (Deg)			

Notes / Comments			
Corrosion was located at the bottom of the 4 Special Bolts. (below the o-ring)			
			
* Note special bolts are stainless steel! the corrosion came from the igniter chamber O ₂ ports.			

Morton Thiokol Inc.
Space Operations

Table A-V
Igniter Putty Condition – Evaluation Checkoff Worksheet

Inspector(s): <u>Pat McCluskey</u>			
Motor No.: <u>26A</u>	Side: <input checked="" type="checkbox"/> Left(A) <input type="checkbox"/> Right(B)	Date: _____	
Joint: <input checked="" type="checkbox"/> Adapter to Case Igniter to FWD Dome			
A. Putty Condition			
1. Color?	<u>X</u> Variable	_____ Constant	
2. Tack?	<u>X</u> Good	_____ Nominal	_____ Poor
B. Putty Gas Paths?		<u>X</u> Yes	_____ No
C. Putty Adhesive/Cohesive Failure?		<u>X</u> Yes	<u>PM</u> No
Clarify below or on a OCF, if necessary			
If any of the above conditions exist, record indicated data below:			
Condition	Degree	Degree	Circumferential
Indicate with:	Location	Arc	Width
B or C	(For B & C)	(For B & C)	(For B & C)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
Notes / Comments			
<p>Putty gas path : Located at 285°</p> <p>Putty application was light from 270 210° - 340°.</p> <p>Blow hole occurred at the thinnest area of putty.</p> <p>* No blowhole or gas path was observed in the ignitor adaptor to igniter chamber joint. No gas or combustion products reach the seals.</p>			
			

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Table A-II

Safe & Arm - Evaluation Checkoff Worksheet

Inspector(s): <i>Pat McCloskey</i>				
Motor No.: <i>26 R</i>		Side: <input type="checkbox"/> Left(A) <input checked="" type="checkbox"/> Right(B)		Date: <i>10-8-88</i>
I.	Heat Affect (Blisters or Discoloration)?	_____ yes	<u><i>X</i></u> no	
II	Physical Damage (Nicks, Scratches, Gouges)?	_____ yes	<u><i>X</i></u> no	
III.	Corrosion?	_____ yes	<u><i>X</i></u> no	
If yes, note:				
	Condition (I, II, or III)	Degree Location (Deg.)	Circumferential Width (In.)	Degree Arc
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
Notes / Comments <i>No unacceptable conditions</i>				

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Space Operations

Table A-IV
Igniter Instrumentation (Removed) - Evaluation Checkoff Worksheet

Inspector(s): <u>Pat McCloskey</u>			
Motor No.: <u>26A</u>		Side: <input type="checkbox"/> Left(A) <input checked="" type="checkbox"/> Right(B)	Date: <u>10-9-88</u>
I. Evidence of Combustion Product Leakage (i.e. Soot)?			
A. Transducers		_____ yes	<u>X</u> no
B. Transducer Bolt Assemblies		_____ yes	<u>X</u> no
C. Plugs		_____ yes	<u>X</u> no
If Yes:			
Affected Part (A, B or C)		Degree Location (Deg)	
_____		_____	
_____		_____	
_____		_____	
_____		_____	
II. Physical Damage (Nicks, Scratches, Gouges)?			
A. Transducers		_____ yes	<u>X</u> no
B. Transducer Bolt Assemblies		_____ yes	<u>X</u> no
C. Plugs		_____ yes	<u>X</u> no
If Yes:			
Affected Part (A, B or C)		Degree Location (Deg)	
_____		_____	
_____		_____	
_____		_____	
_____		_____	
III. Plugged Ports?			
		_____ yes	<u>X</u> no
If Yes:			
Degree Location (Deg)			

Notes / Comments <u>corrosion from the igniter chamber was deposited on the bottom end of all 4 special bolts.</u>			

Table A-V

Igniter Putty Condition – Evaluation Checkoff Worksheet

Inspector(s): <u>Pat McCluskey</u>			
Motor No.: <u>26R</u>	Side: <input type="checkbox"/> Left(A) <input checked="" type="checkbox"/> Right(B)	Date: <u>10-9-88</u>	
Joint: <input checked="" type="checkbox"/> Adapter to Case Chamber <input checked="" type="checkbox"/> Igniter to Fuel Dome			

A. Putty Condition

1. Color? Variable ☒ Constant

2. Tack? ☒ Good Nominal Poor

B. Putty Gas Paths? ☒ Yes No

C. Putty Adhesive/~~Cohesive~~ Failure? ☒ Yes No

Clarify below or on a OCF, if necessary

If any of the above conditions exist, record indicated data below:

Condition	Degree	Degree	Circumferential
Indicate with:	Location	Arc	Width
B or C	(For B & C)	(For B & C)	(For B & C)

Notes / Comments

Putty gas path located at 320°. Putty application was uniform and consistent.

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Space Operations

Table B-I
Igniter Insulation - Evaluation Checkoff Worksheet

Inspector(s): <u>Pat McCloskey</u>					
Motor No.: <u>26A</u>				Date: <u>10-9-88</u>	
Side: <input type="checkbox"/> Left(A) <input checked="" type="checkbox"/> Right(B)					
Part: <input type="checkbox"/> A. Igniter Chamber Exterior / <u>adapter</u>					
I. Severe or Abnormal Insulation Erosion?		_____ yes		<u>X</u> no	
II. Blistering?		_____ yes		<u>X</u> no	
If yes, record:					
Condition (I or II)	Axial Location (In.)	Degree Location (Deg.)	Axial Length (In.)	Circumferential Width (In.)	Degree Arc
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Notes / Comments

sea water had washed off most of the char. Erosion pattern and depth is acceptable and within acceptable limits (adapter internal, chamber internal/external, initiator external)

Morton Thiokol Inc.
Space Operations

Table B-I
Igniter Insulation - Evaluation Checkoff Worksheet

Inspector(s): <u>PAT McCloskey</u>					
Motor No.: <u>26 R</u>				Date: <u>10/9/88</u>	
Side: <input checked="" type="checkbox"/> Left(A) <input type="checkbox"/> Right(B)					
Part: <input checked="" type="checkbox"/> A. Igniter Chamber Exterior / <u>adapter</u>					
I. Severe or Abnormal Insulation Erosion? <u> </u> yes <u> X </u> no					
II. Blistering? <u> </u> yes <u> X </u> no					
If yes, record:					
	Axial		Axial		
Condition	Location (In.)	Degree	Length (In.)	Circumferential	Degree
(I or II)		Location (Deg.)		Width (In.)	Arc
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
Notes / Comments					
<p>Most of the char was washed off in the ocean. Insulation erosion patterns were normal and as expected. No hot spots or un uniform erosion patterns.</p> <p>(adapter internal, chamber internal/external/ initiator external</p>					

Morton Thiokol Inc.
Space Operations

Table A-VI
Igniter Nozzle Insert - Evaluation Checkoff Worksheet

Inspector(s): <u>Pat McCluskey</u>				
Motor No.: <u>26A</u>	Side: <input type="checkbox"/> Left(A) <input checked="" type="checkbox"/> Right(B)		Date: <u>10-9-88</u>	
I. Cracked Nozzle Insert?		<u> </u> yes	<u>X</u> no	
II. Chipped Nozzle Insert?		<u> </u> yes	<u>X</u> no	
If Yes:				
Condition (I or II)	Degree Location (Deg.)	Axial Length (In.)	Circumferential Width (In.)	Degree Arc
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
Notes / Comments				
<u>Nozzle insert looked normal. No unacceptable conditions</u>				

Table A-VI
 Igniter Nozzle Insert - Evaluation Checkoff Worksheet

Inspector(s): <u>Pat McCluskey</u>				
Motor No.: <u>26R</u>	Side: <input checked="" type="checkbox"/> Left(A) <input type="checkbox"/> Right(B)	Date: <u>10/9/88</u>		
I. Cracked Nozzle Insert? _____ yes <u>X</u> no				
II. Chipped Nozzle Insert? _____ yes <u>X</u> no				
If Yes:				
Condition (I or II)	Degree Location (Deg.)	Axial Length (In.)	Circumferential Width (In.)	Degree Arc
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
Notes / Comments <u>Nozzle insert functioned normally. No unacceptable conditions</u>				

Morton Thiokol Inc.
Space Operations

Table A-I
External Ignition System - Evaluation Checkoff Worksheet

Inspector(s): <u>Pat McCluskey</u>						
Motor No.: <u>26A</u>		Side: <input type="checkbox"/> Left(A) <input checked="" type="checkbox"/> Right(B)		Date: <u>10-9-88</u>		

I. Hotspots (Blisters or Discoloration) on Igniter Adapter? yes X no

If yes:

Condition	Degree Location (Deg.)	Radial Location (In.)	Radial Distance (In.)	Circumferential Width (In.)	Degree Arc

II. Physical Damage (Nicks, Scratches, Gouges)?

A. Adapter yes X no

B. Adapter Bolts (Outer Circle) yes X no

C. Adapter Bolts (Inner Circle) yes X no

D. S&A Bolts yes X no

If yes, note the affected part (A, B, C or D) and the indicated data:

Affected Part	Condition	Degree Location (Deg.)	Radial Location (In.)	Radial Distance (In.)	Circumferential Width (In.)	Degree Arc

III. Corrosion?

A. Adapter X yes no

B. Adapter Bolts (Outer Circle) yes X no

C. Adapter Bolts (Inner Circle) yes X no

D. S&A Bolts yes X no

If yes, note the affected part (A, B, C or D) and the indicated data:

Affected Part	Degree Location (Deg.)	Radial Location (In.)	Radial Distance (In.)	Circumferential Width (In.)	Degree Arc
<u>A</u>	<u>160</u>		<u>10.75"</u>	<u>1"</u>	<u>5°</u>
<u>A</u>	<u>250</u>		<u>11</u>	<u>1</u>	<u>5°</u>
<u>A</u>	<u>0-360</u>		<u>10.75</u>		<u>360°</u>

Notes / Comments
 light rust was on the adapter outer gasket sealing surface intermittently around the entire circumference. corrosion was not past the primary outer gasket seal.

Morton Thiokol Inc.
Space Operations

Table A-I
 External Ignition System - Evaluation Checkoff Worksheet

Inspector(s): <u>Pat McCluskey</u>						
Motor No.: <u>26R</u>		Side: <input checked="" type="checkbox"/> Left(A) <input type="checkbox"/> Right(B)		Date: <u>10/8/88</u>		

I. Hotspots (Blisters or Discoloration) on Igniter Adapter? yes X no

If yes:

Condition	Degree Location (Deg.)	Radial Location (In.)	Radial Distance (In.)	Circumferential Width (In.)	Degree Arc

II. Physical Damage (Nicks, Scratches, Gouges)?

A. Adapter yes X no

B. Adapter Bolts (Outer Circle) yes X no

C. Adapter Bolts (Inner Circle) yes X no

D. S&A Bolts yes X no

If yes, note the affected part (A, B, C or D) and the indicated data:

Affected Part	Condition	Degree Location (Deg.)	Radial Location (In.)	Radial Distance (In.)	Circumferential Width (In.)	Degree Arc

III. Corrosion?

A. Adapter X yes no

B. Adapter Bolts (Outer Circle) yes X no

C. Adapter Bolts (Inner Circle) yes X no

D. S&A Bolts yes X no

If yes, note the affected part (A, B, C or D) and the indicated data:

Affected Part	Degree Location (Deg.)	Radial Location (In.)	Radial Distance (In.)	Circumferential Width (In.)	Degree Arc
<u>A</u>		<u>10.5 R</u>	<u>10.5 R</u>	<u>360°</u>	<u>360°</u>

Notes / Comments

rust Corrosion was located on the igniter adapter sealing surface (outer gasket) 360° intermittently around entire circumference up to the primary seal in the outer gasket

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